CLAIMS

1. A method of p-type doping in ZnO comprising:

forming an acceptor-doped material having ZnO under reducing conditions, thereby insuring a high donor density; and

annealing the specimens of said acceptor-doped material at intermediate temperatures under oxidizing conditions so as to remove intrinsic donors and activate impurity acceptors.

2. The method of claim 1, wherein said reducing conditions comprise a hydrogen containing atmosphere.

3. The method of claim 1, wherein said reducing conditions comprise a non- hydrogen containing atmosphere.

4. The method of claim 1, wherein said acceptor-doped material comprises a substrate, a n-type ZnO layer deposited on said substrate, and a p-type layer deposited on said n-type ZnO layer.

5. The method of claim 1, wherein said intermediate temperatures comprise a temperature range between 200 °C and 700 °C.

6. A method of forming p-n junctions using p-type ZnO comprising:

forming an acceptor-doped material having ZnO under reducing conditions, thereby insuring a high donor density; and

annealing the specimens of said acceptor-doped material at intermediate temperatures under oxidizing conditions so as to remove intrinsic donors and activate impurity acceptors.

7. The method of claim 6, wherein said reducing conditions comprise a hydrogen containing atmosphere.

8. The method of claim 6, wherein said reducing conditions comprise a non- hydrogen containing atmosphere.

9. The method of claim 6, wherein said acceptor-doped material comprises a substrate, a n-type ZnO layer deposited on said substrate, and a p-type layer deposited on said n-type ZnO layer.

10. The method of claim 6, wherein said intermediate temperatures comprises a temperature range between 200 °C and 700 °C.

11. A wide band gap semiconductor device comprising an acceptor-doped material having ZnO that is formed under reducing conditions, thereby insuring a high donor density; wherein the specimens of said acceptor-doped material are annealed at intermediate temperatures under oxidizing conditions so as to remove intrinsic donors and activate impurity acceptors.

12. The wide band gap semiconductor device of claim 11, wherein said reducing conditions comprise a hydrogen containing atmosphere.

13. The wide band gap semiconductor device of claim 11, wherein said reducing conditions comprise a non- hydrogen containing atmosphere.

14. The wide band gap semiconductor device of claim 11, wherein said acceptor-doped material comprises a substrate, a n-type ZnO layer deposited on said substrate, and a p-type layer deposited on said n-type ZnO layer.

15. The wide band gap semiconductor device of claim 11, wherein said intermediate temperatures comprise a temperature range between 200 $^{\circ}$C and 700 $^{\circ}$C.

16. A p-n junction comprising an acceptor-doped material having ZnO that is formed under reducing conditions, thereby insuring a high donor density; wherein the specimens of said acceptor-doped material are annealed at intermediate temperatures under oxidizing conditions so as to remove intrinsic donors and activate impurity acceptors.

17. The p-n junction of claim 16, wherein said reducing conditions comprise a hydrogen containing atmosphere.

18. The p-n junction of claim 16, wherein said reducing conditions comprise a non-hydrogen containing atmosphere.

19. The p-n junction of claim 16, wherein said acceptor-doped material comprises a substrate, a n-type ZnO layer deposited on said substrate, and a p-type layer deposited on said n-type ZnO layer.

20. The p-n junction of claim 16, wherein said intermediate temperatures comprises a temperature range between 200 $^{\circ}$C and 700 $^{\circ}$C.